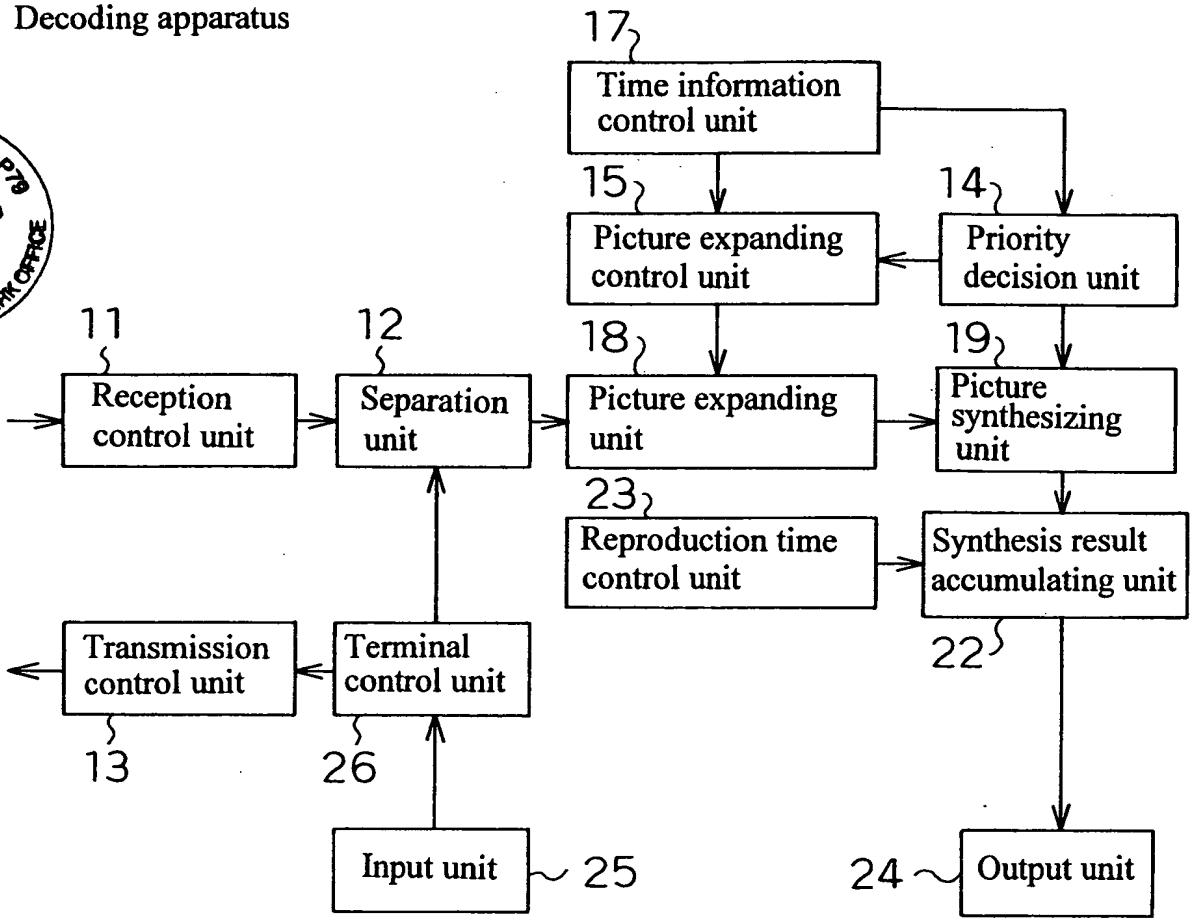
Fig. 1

Decoding apparatus



Coding apparatus

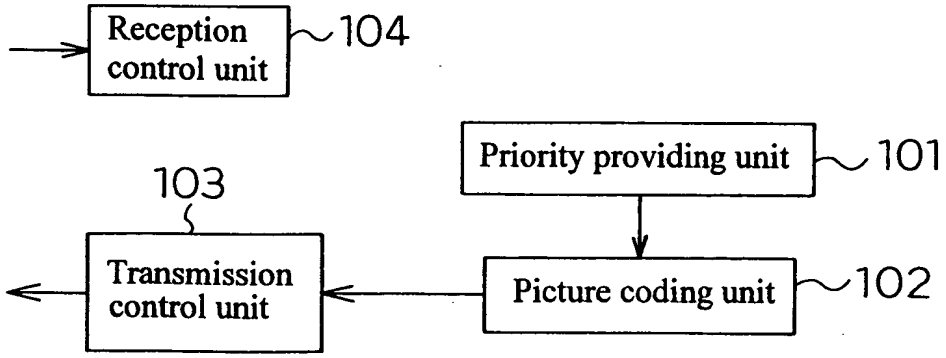
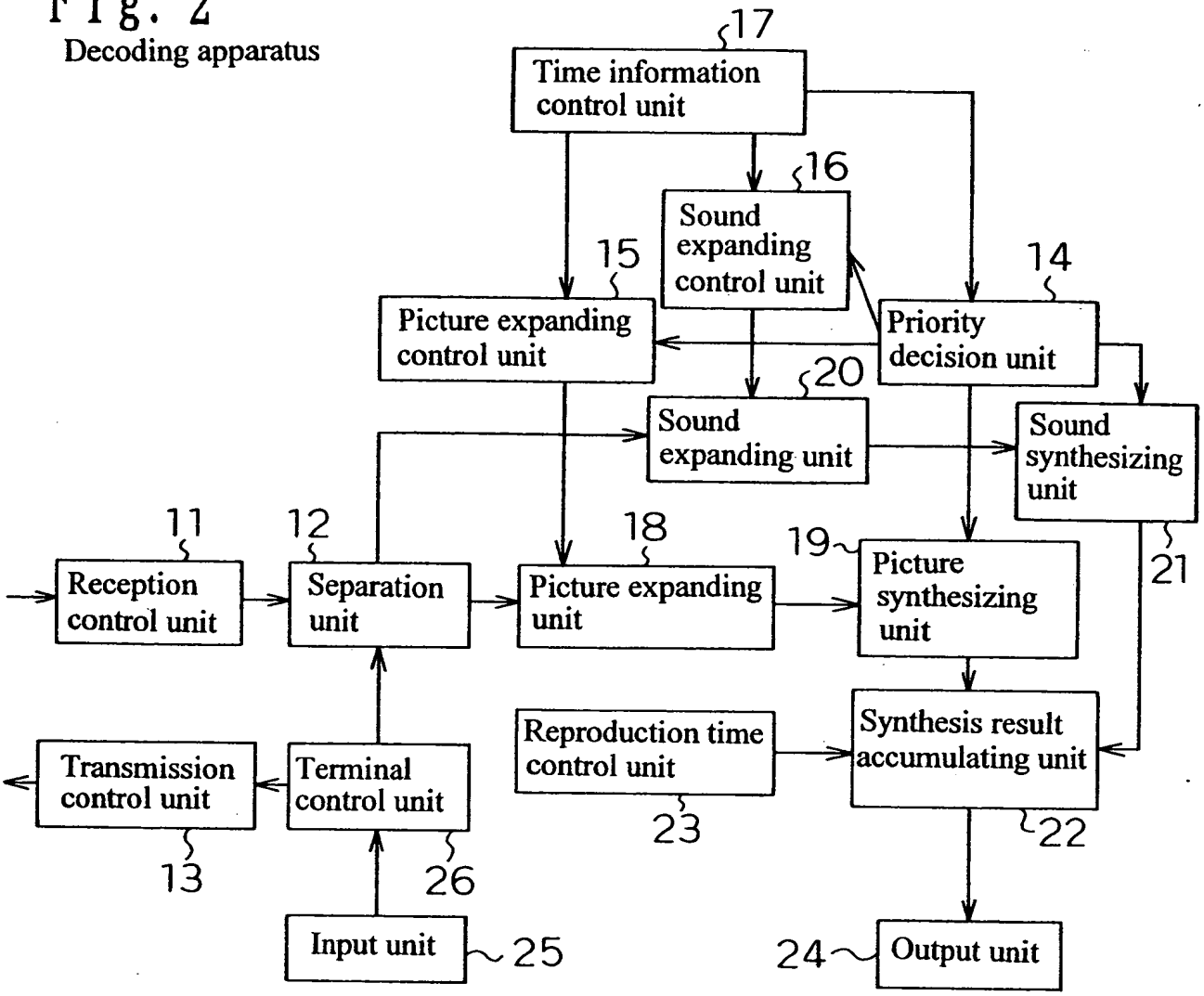


Fig. 2

Decoding apparatus



Coding apparatus

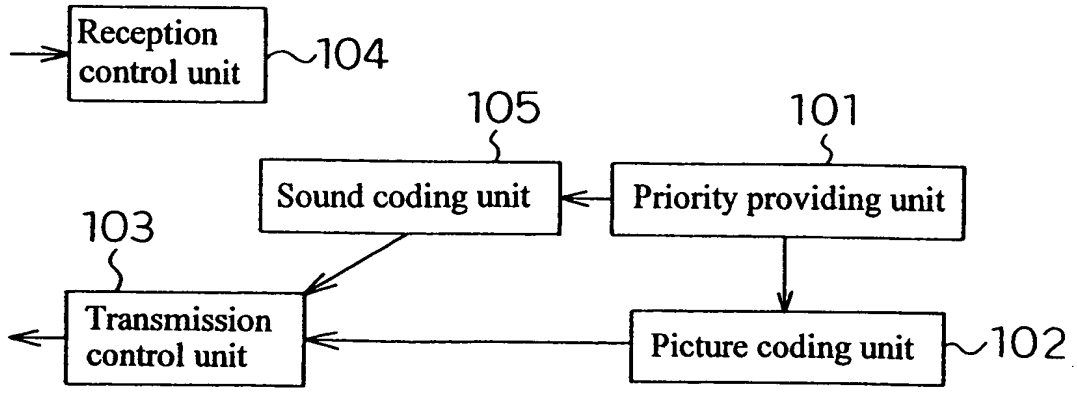


Fig. 3 (a)

All multiplexed format

Header information	Priority for defining reproduction sequence	Priority for defining processing when overloaded	Picture data 1	Sound data 1	-------	Picture data N	Sound data N

Information showing display sequence

* The information describing the relation between pictures or between sounds may be described in the header information.

Fig. 3 (b)

Multiplexed in individual media, and transmitted from respective communication ports

Header information	Priority for defining reproduction sequence	Priority for defining processing when overloaded

Control information

Header information	Picture data 1	-------	Picture data N

Picture data row

Header information	Sound data 1	-------	Sound data N

Sound data row

REPLACEMENT PAGE
Inventor: Takao Yamaguchi et al.
PICTURE AND SOUND DECODING APPARATUS ...
Atty. Docket No. MDA-2570US; Customer No. 23122

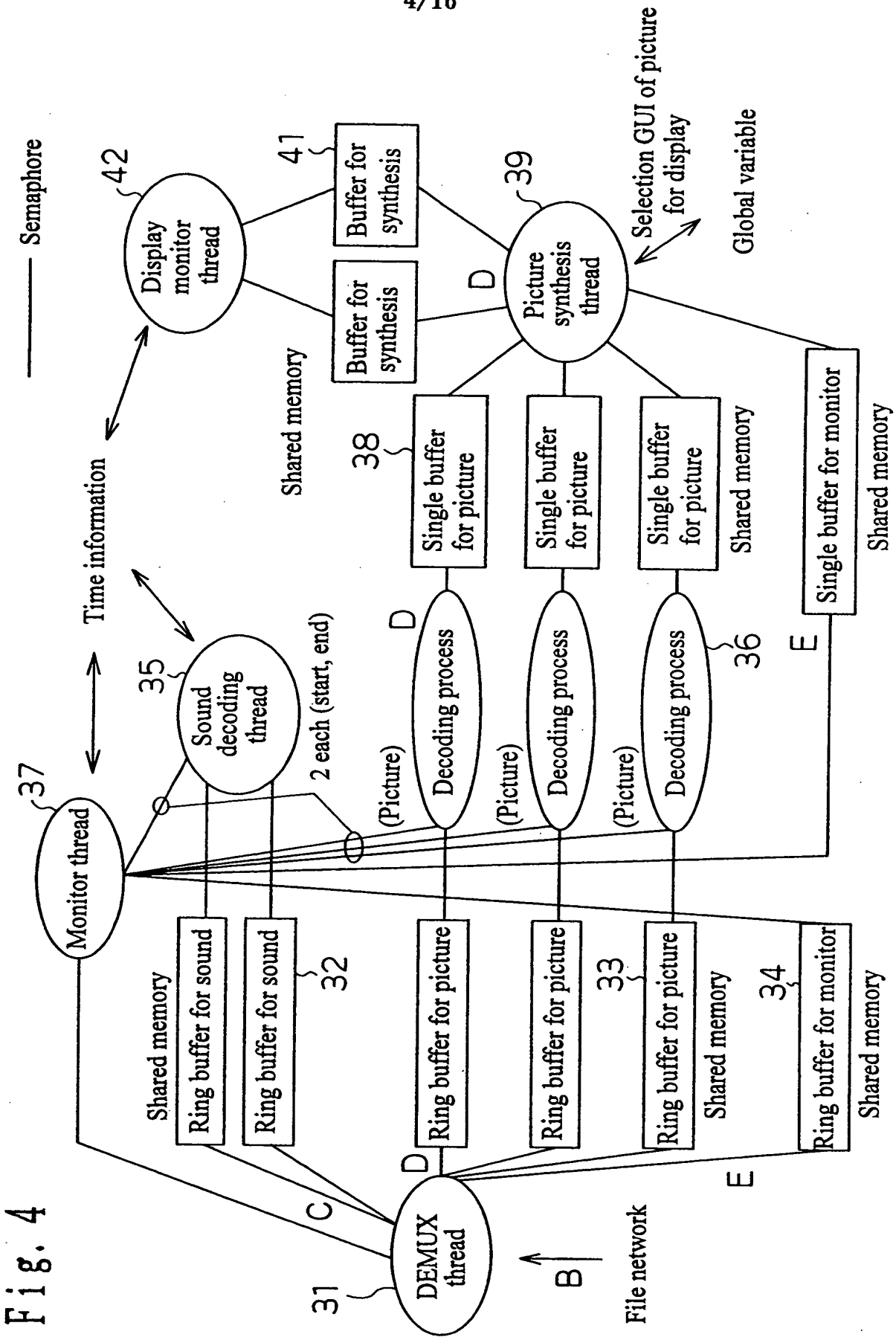

Semaphore
Time information
Shared memory
Global variable
Selection GUI of picture for display
Monitor thread
37
Sound decoding thread
35
Display monitor thread
42
Buffer for synthesis
41
Buffer for synthesis
Picture synthesis thread
39
Single buffer for picture
38
Single buffer for picture
Single buffer for picture
Shared memory
Single buffer for monitor
Shared memory
2 each (start, end)
(Picture)
Decoding process
D
(Picture)
Decoding process
(Picture)
Decoding process
36
E
Shared memory
Ring buffer for sound
Ring buffer for sound
32
Ring buffer for picture
Ring buffer for picture
33
Ring buffer for picture
Shared memory
34
Ring buffer for monitor
Shared memory
C
D
E
DEMUX thread
31
B
File network

Fig. 4

Fig. 5

B.

```
struct shm_tspkt  {
     data_byte        188byte          Packet data
}
```

C.

```
struct shm_apkt  {
   DWORD  sync_code          32bit  Packet synchronous code
   WORD   pts                16bit  Display time
   WORD   frame_length       16bit  Frame length
   BYTE   data_byte          Nbyte  Sound data
                                    (N=frame_length)
}
```

D.

```
struct shm_vpkt  {
   DWORD  sync_code          32bit  Packet synchronous code
   BYTE   temporal_reference 8bit   Frame number
   WORD   frame_length       16bit  Frame length
   BYTE   data_byte          Nbyte  Picture data
                                    (N=frame_length)
}
```

E.

```
struct shm_kanshi_Info  {
   WORD  pts                  16bit    Display time
   BYTE  number_of_object     8bit     No. of objects
   for (i=0:  i<number_of_object:i++)     {
     BYTE   object_id           8bit       ID
     BYTE   temporal_reference  8bit       Frame number
     BYTE   object_priority     4bit       Priority (*1)
            reserved            2bit
            IPB_flag            2bit       Frame type
     WORD   horizontal_offset   10bit   Display position, horizontal
     WORD   vertical_offset     10bit   Display position, vertical
     BYTE   layer               4bit       Layer
   }
}
```

(*1) Bits are assigned from the highest position sequentially by 4 bits (object_priority), 2 bits, 2 bits (IPB_flag)

Fig. 6

DEMUX thread

```
void demux ( )
{
      Shared memory (ring), semaphore generation process: for output
            (2 for sound, 3 for picture, 1 for monitor table)
      Semaphore generation for monitor thread control (one)
      BOOL  flag = TRUE:  //  State of ring buffer

      while(1) {
          if(flag)  Reading from file or network                          - (5-1)

          if(flag)
              Analysis of 188-byte packet data, setting in specified structure   - (5-2)
               (decomposed into information of sound, picture, monitor table)

          //  Exclusive control of ring buffer by semaphore
          if  (Able to write in ring buffer?){
              Write into ring buffer (from earlier object ID, write sequentially  - (5-3)
                        into shared memory of earlier buffer number)
              Advance write pointer of written buffer                     - (5-4)
              flag=TRUE:
          }else
              flag=FALSE: //  Prevent overflow of ring buffer

          if(flag)
              After writing information of pictures and sounds for one monitor  - (5-5)
              table, advance the counter of semaphore for monitor thread control
      }
}
```

Fig. 7

Monitor thread

```
void Watch Process ( )
{
     BYTE disp_TR[i]:  //  Picture serial number (shared memory)
     BOOL skip_flag[i]:  //  Skip flag to which decoding process refers
                                (shared memory)

    Shared memory (ring buffer: monitor table 1)
                        Semaphore open: used by determining priority of processing
    Shared memory (single buffer: monitor table 1)
                        Semaphore generation: transfer to synthesis side
    Generation of semaphore for process monitor
    Semaphore open for monitor thread control (one)

    Start of picture decoding process
    Confirm start of process
    while {skip_flag[i]=FALSE:  //  Not skipped  }

    while(1)
    {
        Reading of monitor table (read pointer update, from DEMUX)
        Check of object priority                                  - (6-1)  - (6-2)
        Writing of monitor table (to synthesis side)                       - (6-3)
        Wait for creation of data for one monitor table from DEMUX         - (6-4)

        From highest priority
        {
           disp_TR[i]=TR:                                                  - (6-5)
           if   ( Present time > display time (pts) )  {                   - (6-6)
                    Not skipped if I frame
                    skip_flag[i]=FALSE
           }else{
                   P, B frames are skipped
                   skip_flag[i]=TRUE
           }
          Release of semaphore of corresponding process                    - (6-7)
          Wait for release of semaphore of corresponding process           - (6-8)
                                        (process completion check)
        }
    }
}
```

Fig. 8

Decoding process

```
void main(int argc, char *argv[ ] )
{
```

Value received from main process :
Shared memory to be opened, name of semaphore

Shared memory (ring), open processing of semaphore: for input (from MUX)
Shared memory (single), open processing of semaphore: for output (to synthesis side)

```
while(1)  {
```

Monitor thread waits for release of semaphore – (7-1)

Input picture state check: – (7-2)
Picture serial number (TR), skip input frame?

Wait for picture data to be decoded – (7-3)

Is TR present in shared memory? { – (7-4)
Skip decoding if not present
Advance read pointer for ring buffer (for input)
}

```
if (Skip one input frame) {
```

Decoding process – (7-5)
Advance read pointer for ring buffer (for input)
}

Output of decoding result (*1) – (7-6)
Release semaphore to monitor thread (process end notice) – (7-7)

```
  }
}
```

(*1) When skipping input frame process, send signal to main process without decoding process and output of decoding result

Fig. 9

Picture synthesis thread

```
void Watch Sync ( )
{
    Shared memory (single), semaphore generation process: for input (from decoder)
    Shared memory (single), semaphore generation process: for input (from monitor
                                                                    thread)
    Shared memory (single), semaphore generation process: for output (to display
                                                                    monitor: 2)
    BOOL flag=TRUE:

    while(1)  {
        Wait for monitor table from monitor thread                  - (8-1)
        Check priority order of object                              - (8-2)

        From highest priority order  {                              - (8-3)
              Wait for picture of decoding result (accumulated in shared memory)
              //  Totally black if empty
        }
        Synthesis of image adjusting to display position            - (8-4)

        //   Double buffer
        if (flag)  {                                                - (8-5)
            Write synthesis result into shared memory (to display monitor) #1
            flag=FALSE:
        } else  {
              Write synthesis result into shared memory (to display monitor)#2
              flag=TRUE:
        }
    }
}
```

Fig. 10

Display monitor thread

```
void Watch Disp ( )
{
    Shared memory (single), open processing of semaphore: for input
                                                (from synthesis thread: 2)
    BOOL  flag = TRUE:

    while(1)
    {
        // Double buffer
        if (flag)  {
            Wait for synthesis picture from shared memory (from synthesis thread)#1
            flag = FALSE:                                          - (9-1)
        } else {
            Wait for synthesis picture from shared memory (from synthesis thread)#2
            flag = TRUE:
        }

        if (Initial display)  {
            Acquire display start time from timer                  - (9-2)
        }
        Sleep (pts-nowtime) :                                      - (9-3)
          Display of synthesis picture
    }
}
```

Fig. 11

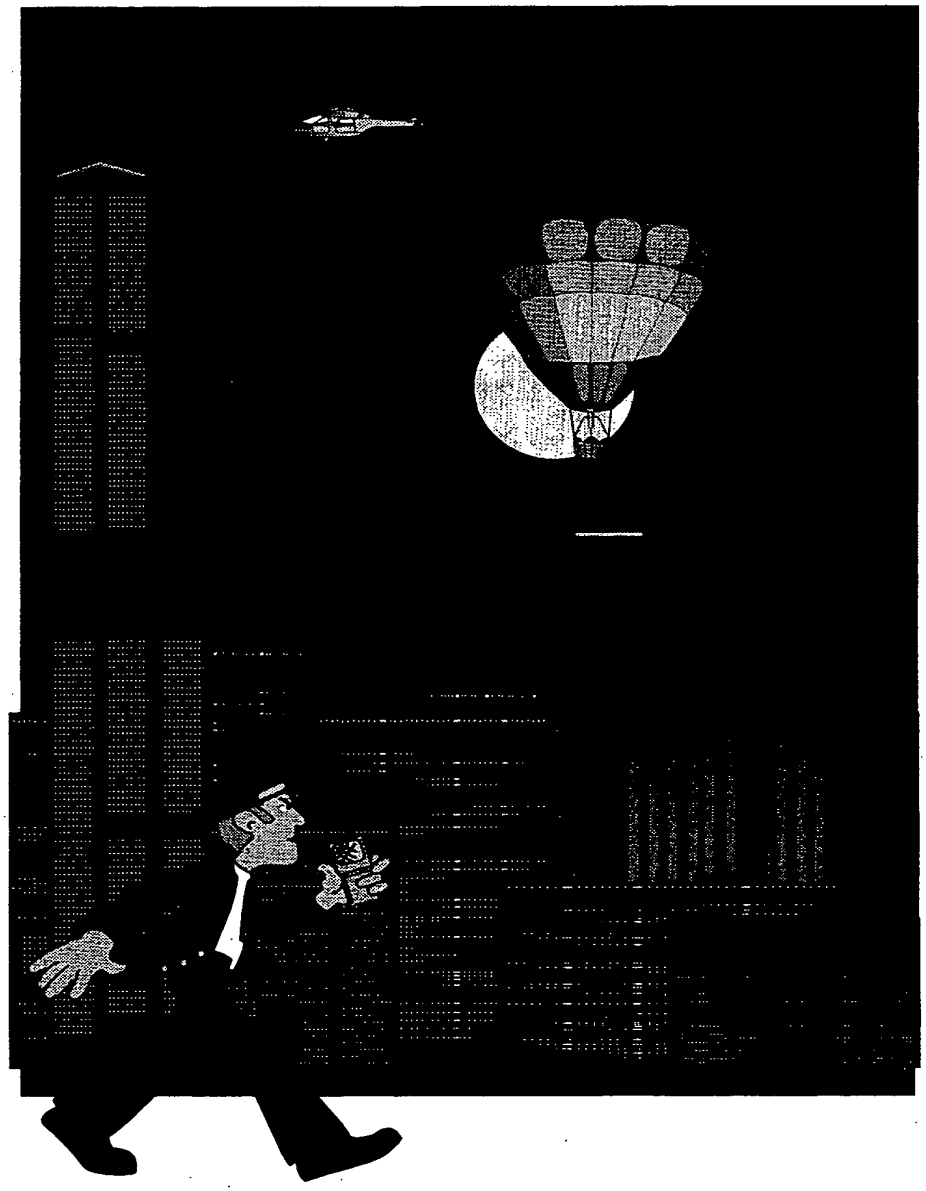


Fig. 12 (a)

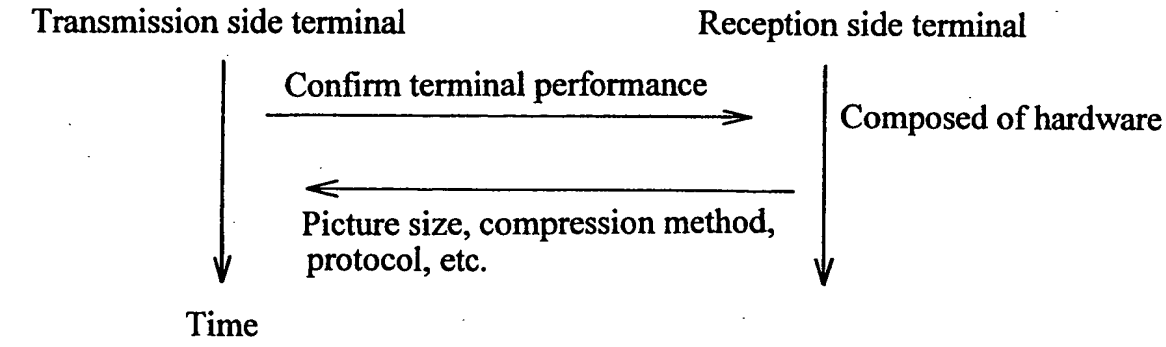


Fig. 12 (b)

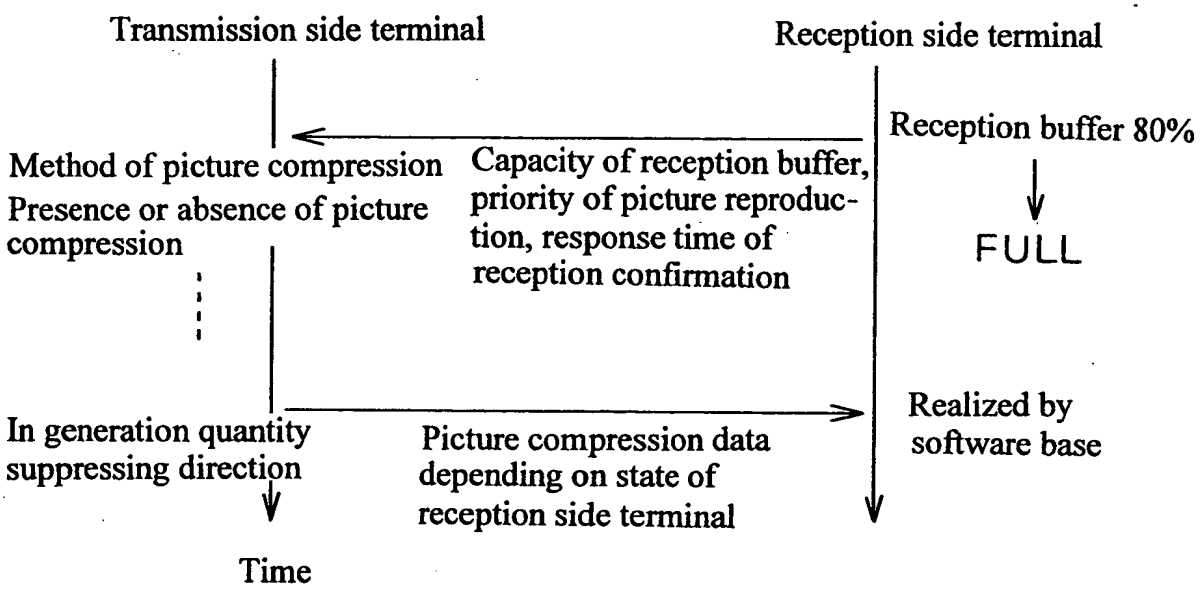
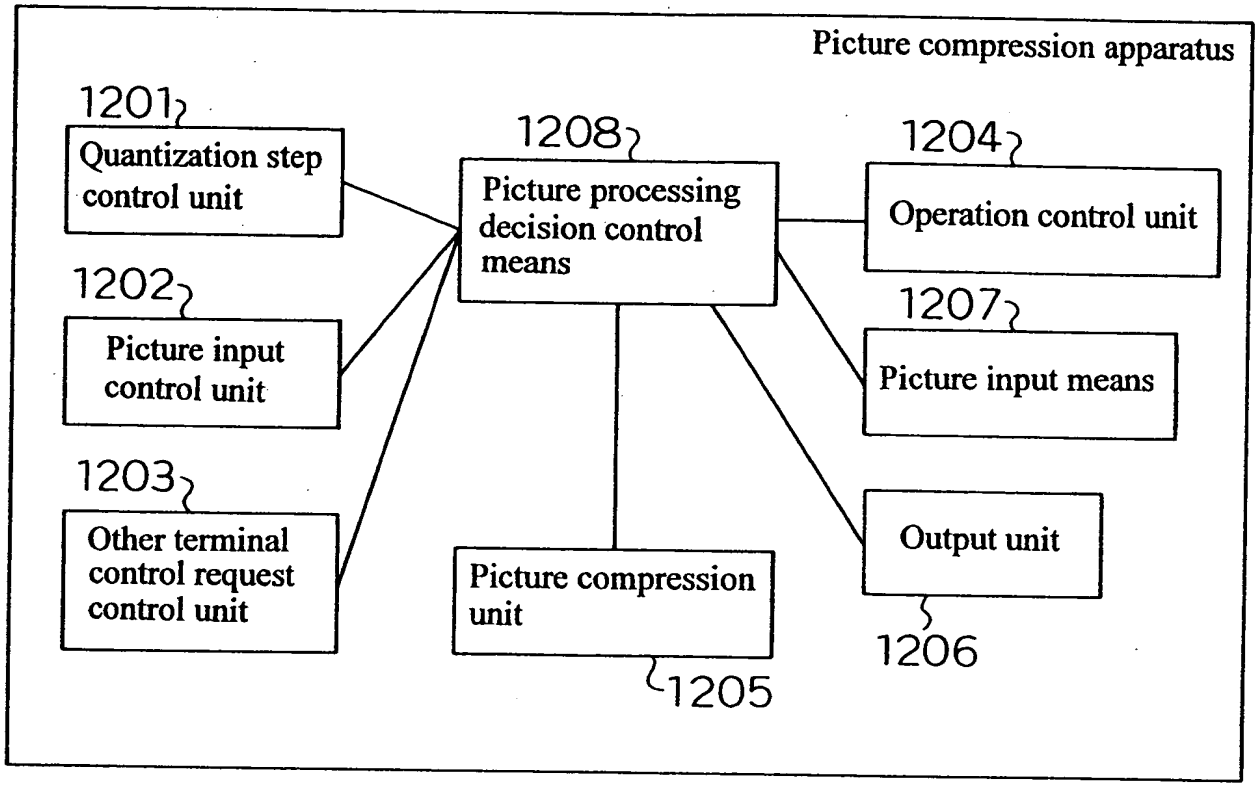


Fig. 13



* Sound compression apparatus can be set similarly

Fig. 14

Picture size	Camera control	Other terminal control request	Quantization step
QCIF	Pan	Buffer over	16
CIF	None	None	16
QCIF	None	None	18
QCIF	Tilt	None	14
⋮	⋮	⋮	⋮

Fig. 15

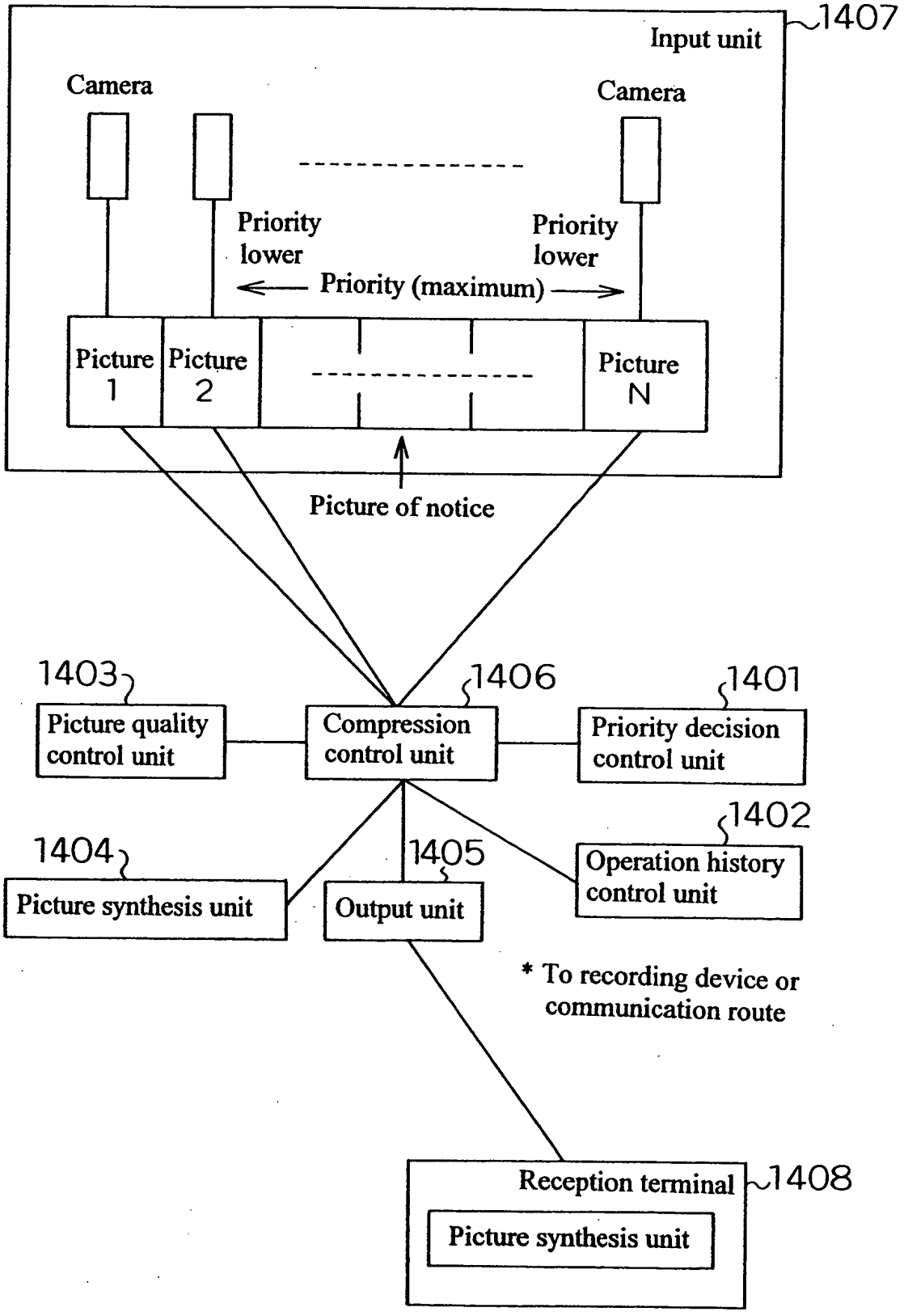
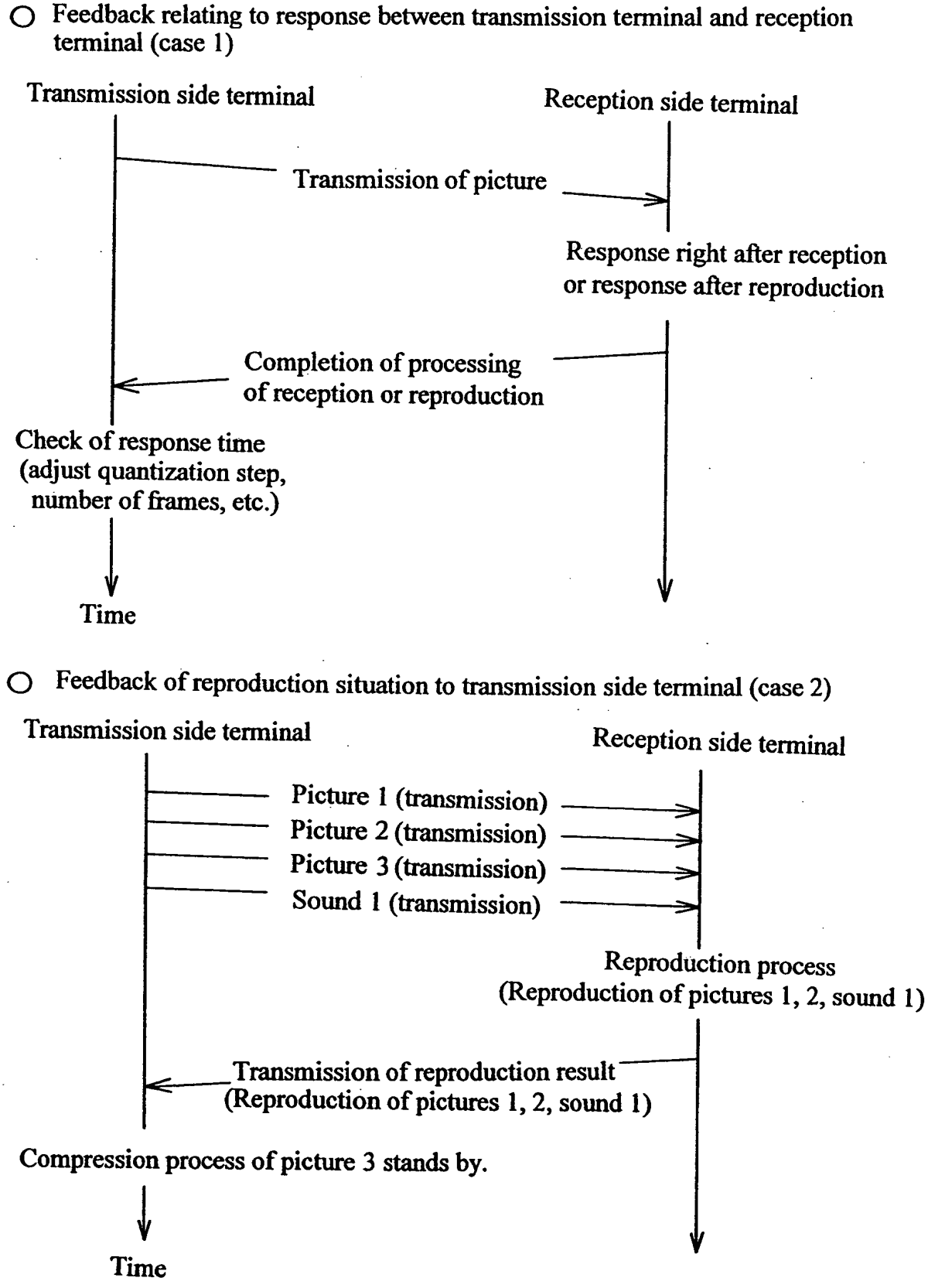

Input unit
1407
Camera
Camera
Priority lower
Priority lower
Priority (maximum)
Picture 1
Picture 2
Picture N
Picture of notice
1403
Picture quality control unit
1406
Compression control unit
1401
Priority decision control unit
1402
Operation history control unit
1404
Picture synthesis unit
1405
Output unit
* To recording device or communication route
Reception terminal
1408
Picture synthesis unit

Fig. 16


○ Feedback relating to response between transmission terminal and reception terminal (case 1)
Transmission side terminal
Reception side terminal
Transmission of picture
Response right after reception or response after reproduction
Completion of processing of reception or reproduction
Check of response time (adjust quantization step, number of frames, etc.)
Time
○ Feedback of reproduction situation to transmission side terminal (case 2)
Transmission side terminal
Reception side terminal
Picture 1 (transmission)
Picture 2 (transmission)
Picture 3 (transmission)
Sound 1 (transmission)
Reproduction process
(Reproduction of pictures 1, 2, sound 1)
Transmission of reproduction result
(Reproduction of pictures 1, 2, sound 1)
Compression process of picture 3 stands by.
Time